CLAIMS

We claim:

1. A compound that competitively inhibits binding of CSP to *S. mutans* histidine kinase.

2. The compound of claim 1, comprising a peptide or an antibody.

3. The compound of claim 2, comprising a derivative of [SEQ ID NO:2], a fragment of [SEQ ID NO:2] or a derivative of a fragment of [SEQ ID NO:2].

4. The compound of claim 3, wherein amino acids are removed from the N-terminus and/or C-terminus of [SEQ ID NO:2].

5. A pharmaceutical composition comprising all or part of the peptide of claims 1 to 4 and a carrier.

6. A method of medical treatment or prophylaxis of caries or endocarditis, comprising administering the compound of any of claims 1 to 4 or the pharmaceutical composition of claim 5.

7. An isolated nucleic acid molecule encoding a *S. mutans* competence signal peptide, or a fragment of a peptide having CSP activity.

8. An isolated nucleic acid molecule encoding a competence signal peptide, or a fragment of a competence signal peptide having *S. mutans* competence signal peptide activity, comprising a nucleic acid molecule selected from the group consisting of:

a nucleic acid molecule that hybridizes to all or part of a nucleic acid molecule shown in [SEQ ID NO:1], the fragment of [SEQ. ID NO:1] encoding [SEQ ID NO:2] or a complement thereof under moderate or high stringency hybridization conditions;

a nucleic acid molecule degenerate with respect to (a).

9. An isolated nucleic acid molecule encoding a competence signal peptide, or a fragment of a competence signal peptide having *S. mutans* competence signal peptide activity, comprising a nucleic acid molecule selected from the group consisting of:

the nucleic acid molecule of the coding strand shown in [SEQ ID NO:1], or a complement thereof;

a nucleic acid molecule encoding the same amino acid sequence as a nucleotide sequence of (a); and

a nucleic acid molecule having at least 50% or 60% identity with the nucleotide sequence of (a) or the fragment of [SEQ. ID NO:1] encoding [SEQ ID NO:2].

10. The nucleic acid molecule of claim 9, comprising all or part of a nucleotide sequence shown in [SEQ ID NO:1], the fragment of [SEQ. ID NO:1] encoding [SEQ ID NO:2], or a complement thereof.

11. A CSP nucleic acid molecule isolated from *S. mutans*, or a fragment thereof having CSP activity.

12. A recombinant nucleic acid molecule comprising a nucleic acid molecule of any of claims 7 to 11 and a constitutive promoter sequence or an inducible promoter sequence, operatively linked so that the promoter enhances transcription of the nucleic acid molecule in a host cell.

13. The nucleic acid molecule of any of claims 7 to 11, wherein the molecule comprises genomic DNA, or cDNA.

14. The nucleic acid molecule of any of claims 7 to 11, wherein the nucleic acid molecule is chemically synthesized.

15. The nucleic acid molecule of any of claims 7 to 11, wherein the CSP is involved in genetic competence, biofilm formation, and acid tolerance of *S. mutans*.

16. A vector comprising the nucleic acid molecule of any of claims 7 to 11.

17. A host cell comprising the recombinant nucleic acid molecule of claim 12 or the vector of claim 16, or progeny of the host cell.

18. The host cell of claim 17, selected from the group consisting of a fungal cell, a yeast cell, a bacterial cell, a mammalian cell and a plant cell.

19. A method for producing a recombinant host cell capable of expressing the nucleic acid molecule of any of claims 7 to 11, the method comprising introducing into the host cell a vector of claim 16.

20. A method for expressing a peptide in the host cell of claim 19, the method comprising culturing the host cell under conditions suitable for gene expression.

21. An isolated polypeptide encoded by and/or produced from the nucleic acid molecule of any of claims 7 to 11, or the vector of claim 16.

22. An isolated CSP or a fragment thereof having *S. mutans* CSP activity.

23. The polypeptide of claim 22 comprising a *S. mutans* CSP.

24. The polypeptide of claim 23 comprising all or part of an amino acid sequence in [SEQ ID NO:2].

25. A polypeptide fragment of the peptide of claim 24, or a peptide mimetic of the CSP.

26. The polypeptide of claim 24 which is recombinantly produced.

27. A polypeptide comprising a sequence having greater than 30%, 50% or 60% sequence identity to the polypeptide of claim 24.

28. The polypeptide of claim 24, isolated from *S. mutans*.

29. An isolated nucleic acid molecule encoding the polypeptide of any of claims 21 to 28.

30. An antibody directed against the polypeptide of any of claims 21 to 28.

31. The antibody of claim 30, comprising a monoclonal antibody or a polyclonal antibody.

32. A vaccine composition comprising all or part of the peptide of any of claims 21 to 28 and a carrier.

33. The vaccine composition of claim 32, wherein the peptide is coupled to a compound comprising all or part of KLH, ovalbumin, or thyroglobulin.

34. A method of evaluating caries-reducing properties of a compound comprising contacting the compound with:

CSP, a HK -binding fragment of CSP or a derivative of either of the foregoing; and

HK, a CSP binding fragment of HK or a derivative of either of the foregoing;

wherein (a) and (b) are capable of binding; and determining the ability of the compound to interfere with the binding of a) with b), the ability to interfere with binding indicating that the compound reduces caries.

35. A method of evaluating caries-reducing properties of a compound comprising contacting the compound with:

a DNA vector encoding a marker gene; and

a S. mutans culture;

by determining whether the compound reduces uptake of the DNA vector into the *S. mutans* culture, the reduced uptake of the DNA vector indicating that the compound reduces caries.

36. The method of claim 35, wherein reduction of caries is indicted by reduced transformation efficiency in S. mutans.

37. The method of claim 35, wherein reduction of caries is indicted by determining changes in the physiological characteristics of biofilm formation and acid tolerance in *S. mutans.*